ELECTRICAL EXPERTS TELL OWNERS AND CHAUFFEURS HOW GENERATOR OUTPUT IS REGULATED IN AUTOMOBILE

THE output of a generator in watts is equal to the product of the current in amperes the generator is delivering and the pressure in volts between the terminals of the machine. Either the current or pressure may vary in value, the other remaining practically constant, or both may vary in value. In the majority of cases, however, an attempt is made to maintain either the pressure, frequently called the voltage, or the current practically constant in value, thus giving two main types of systems, known as the constant voltage and constant current systems, respectively.

There are four different methods of regulating the output of a generator, and they may be classified as follows:—

(a) Inherent Regulation.—This type of regulation is that obtained as a result of the characteristics of the generator without the use of any moving parts. In this class are included cumulative and differential series field windings and a type of generator having one or more brushes in addition to those required in dilvering a current in the battery and known as a third brush machine. The field current for the shunt winding is taken from the third brush and one of the main brushes.

Purpose of Electro-Magnets.

(b) Electro-magnetic Regulation.—This type of regulation is produced by the action of electro-magnets, which may act to increase the resistance of the shunt field circuit or to open the field circuit or to change the connections of the field windings.

(c) Mechanical Regulation.—This type of regulation is produced by the action of centrifugally operated governors, which may act to prevent the speed of the generator increasing above a certain definite value or to insert a resistance in series with the field winding or in series with the generator and the battery.

(d) Regulation by Ampere-Hour Meter. This type of regulation is produced by means of an ampere-hour meter, which changes the resistance of the field circuit, depending upon the number of ampere hours that may pass into or out of the storage battery.

All the above types of regulation are found in many different applications and in combination with each other, giving rise to numerous distinctive types as used by the different manufacturers of motor car generators.

. Cumulative Action of Windings.

When the magnetizing action of the current in the series and shunt field windings of a generator are both in the same direction the action is said to be cumulative, and the generator is called a cumulative compound wound machine. A compound wound machine of this kind is used in combination with a constant speed machine. A good example of such a combination is found in some of the older types of equipment manufactured by Gray & Davis, in which the generators were driven at a constant speed by means of a centrifugal clutch.

A diagrammatic scheme of connections for this type of regulation is shown in Fig. 1. When there are no lamps lighted the shunt winding is acting alone and sufficient pressure is generated in the armature winding to overcome the pressure of the battery and produce a charging current. When the lamps are turned on the current through them passes through the series field and increases the magnetic field in which the armature is rotating, thus increasing the electrical pressure generated. By a proper adjustment of the turns in the series field in relation to the current taken by the lamps it is possible to cause the generator to carry the lamp load and to continue to charge the battery at the same rate it was charging the battery before the lamps were turned on.

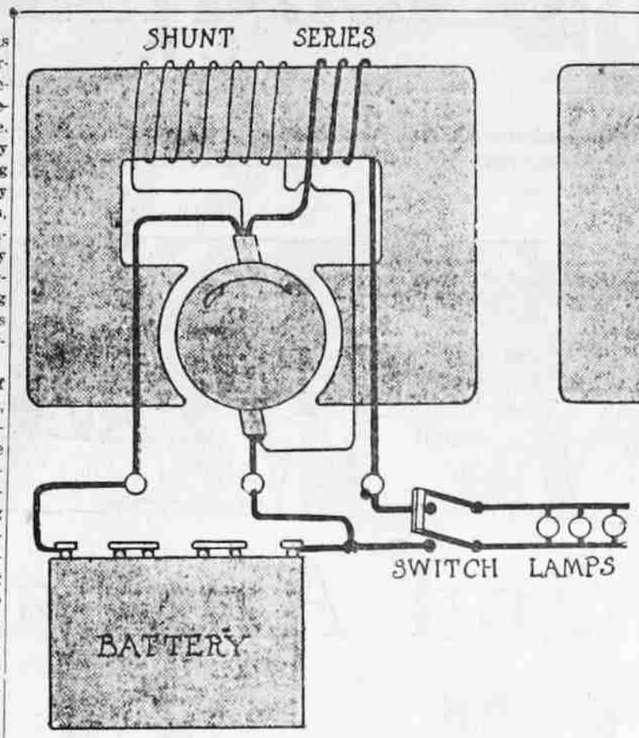


Fig. 1 —Regulation produced by cumulative action of series and shunt fields. The series field carries only the current supplied to the lamps

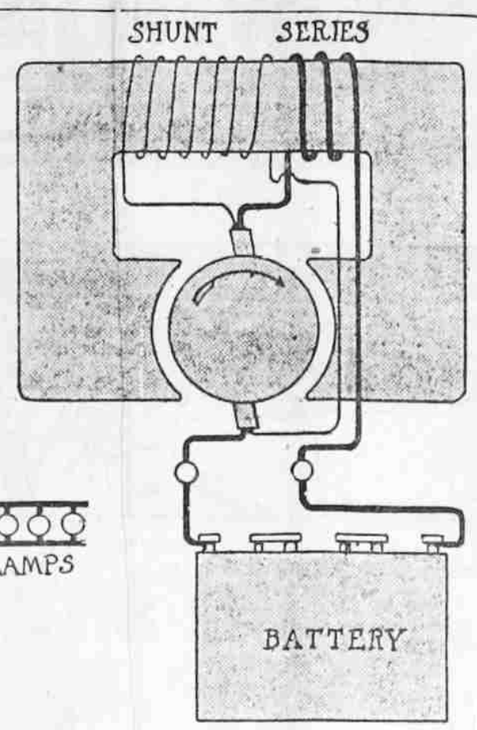


Fig. 2 —Regulation produced by differential action of series and shunt fields. The series field carries the total current supplied by the generator

Courtesy of Motor Age

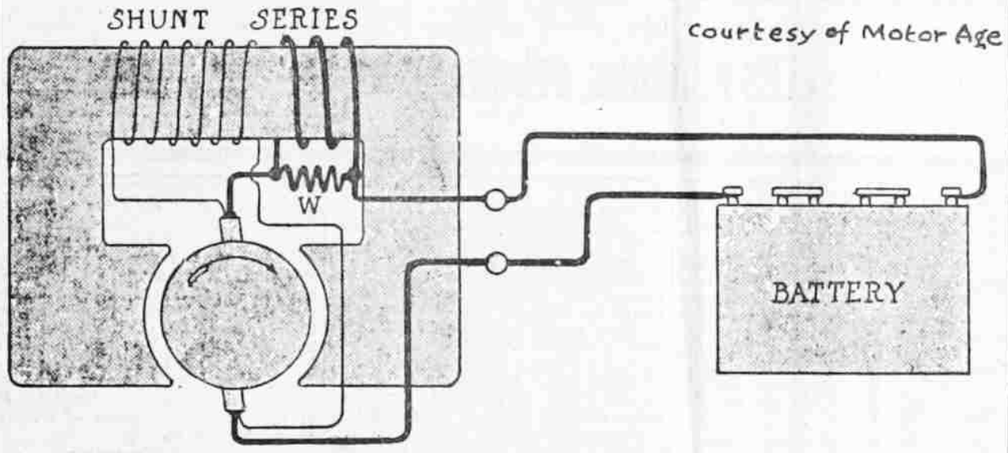


Fig. 3 —Regulation produced by bucking-coil. A coil whose resistance changes with temperature is connected in parallel with the series field, which acts differentially with respect to the shunt field. Here the shunt is shown connected directly across the brushes for simplicity, but in practice the terminal shown here connected to the upper brush is connected to the battery line between the battery and the juncture of the series field and ballast coil. This gives a more even pressure

Differential Action of Windings.

When the magnetizing action of the current in the series and shunt field windings of a generator are in opposite directions the action is said to be differential, and the generator is called a differential compound wound machine. A good example of inherent regulation in which the shunt and series fields produce opposing magnetizing effects is found in one type of equipment made by the Auto-Lite Company. A diagrammatic scheme of connections for this type of regulation is shown in Fig. 2. The action, in brief, is as follows:—The voltage of the machine is built up with an increase in speed and shunt field current until the cutout connects the generator to the battery. After this connection is made a current will be established in the series field winding in such a direction that its magnetizing action is opposite to that produced by the shunt field, and hence the magnetic field is weakened.

With a further increase in speed there will be an increase in generated pressure in the armature of the generator, which will cause an increase in the value of the current produced in the series winding and battery and also an increase in the current in the shunt field winding. Since the magnetizing action of the series field is opposed to the magnetizing action of the shunt field the increase in generated pressure due to an increase in speed will not be as great when both fields are acting as when the shunt field is acting alone. In this case all the current supplied by the dynamo passes through the series field winding.

Bucking Series Field Winding.

The bucking series field winding is really a differential or reserved series field winding, the only difference being that the series field winding does not carry all or necessarily a definite part of the current delivered by the generator. The operation of the bucking coil may be explained by reference to Fig. 3, which is exactly the same as Fig. 2 with a coil of iron wire, W, connected in parallel with the series field winding. The resistance of iron wire increases with an increase in temperature and this increase is very rapid after a certain temperature has been reached. Now, when the current delivered by the generator is small, practically all the current passes through the coil W, as its resistance is much less than the resistance of the series field winding. As the current delivered by the generator increases the temperature of the iron wire will increase. Hence, there is an increase in the resistance it offers, and, as a result, a larger part of the total current delivered by the generator will pass through the series field winding. This increase in current in the series field prevents as large an increase in generated voltage as would occur if no series field were used.

When the current supplied by the generator is reduced the temperature of the iron wire is lowered and the division of the total current between the series field and coil W is restored to its previous value. This system of regulation is used on some of the equipment of the Bosch Magneto Company; also on the equipment of the Rushmore Dynamo Works, which is now a part of the Bosch Magnetic Company.

WHAT THE COST TO MOVE A TON

The Cost of Moving a Ton of Weight Depends Upon Road Conditions Cost of Construction and Maintenance.

Chairman George C. Diehl of the good roads board of the American Automobile association has taken up the task of determining just how much cost attaches to the moving of a ton weight over a mile of distance. In his consideration of the subject he takes up the propositions of cost of road construction, maintenance and other question that enter into the general economies respecting road building.

In his deliberations Mr. Diehl calls attention to the fact that the type of road necessarily enters into the question respecting the needs of a main artery of communication and that it cannot be eliminated. The chairman's statement follows:

"In order to arrive at the ten-mile cost," says Mr. Diehl, "it is essential, first, to have the total cost of construction and maintenance; next, to have the amount of traffic tonnage. The first cost must be the result of a properly kept system of records, and the total cost of maintenance and construction must equal the total outlay made by the highway department, as this is the only method possible to avoid omission of important items. The amount of traffic must be obtained by traffic census. This should be divided between passenger and commercial vehicles and also between motor-driven and horse-drawn vehicles.

"In New York state, where every five or six miles of improved highway is under the control of a patrolman, it would be comparatively easy to obatin such traffic census, as the patrolman could have a certain day each month to make a count of these vehicles, at comparatively no expense to the state. He could also report upon the condition of the highway on the day that the traffic census was taken; give the duration of time that the highway was covered with snow and its condition when the snow came and also after it melted in the spring. Ther are many diverse conditions on the 6,500 miles of state road constructed in the state of New York.

"This traffic census could be taken monthly in a state like New York, and there could be developed the approximate rate of increase, which could be graphically shown in a traffic diagram. Likewise, diagrams could be prepared showing the cost of moving a ton a mile over each of the several types of pavement, and with each of the several kinds of traffic. At the expiration of a year the statistics obtained would be of great value, and after a period of three or four years the results would be of incalculable value. These figures would develop an economic theory of highway construction whereby the character and amount of traffic and type of highway to be constructed could be determined with a degree of exactness which is far from possible at present. The amount and character of traffic in an undeveloped section could be very largely gauged from the territory where statistics are available.

"The statistics thus computed could be compared one county with another, or among the divisions in a state; or among several states, if they would adopt uniform methods, which would make it possible to determine the efficiency of the various highway officials, from the smallest to the largest subdivision. Improved methods in a single section could be adopted in all, and the mistakes corrected at the least expense and in the shortest possible time. It would be merely necessary for a division engineer to call upon the engineer in charge and ask him to explain why the cost was higher than in the adjoining county, and unless a suitable explanation was forthcoming, a new man would be employed in his place. But if there was an explanation, then the conditions spoken of could be controlled by similar methods to those which produced the efficient results in other sections. Likewise, each division engineer could be compelled to maintain a high standard or lose his position, and each state could profit from the experience and abilities manifested in other commonwealths.

"Until some such system is adopted, selection of the type of road is largely a matter of local sentiment, a guess on the part of the highway officials, or due to activities, credible or otherwise, of agents of road building materials. While traffic censuses have been conducted in a somewhat limited way, it has never been attempted to do the work systematically and completely."

—oo—

A German colliery has installed a canteen 500 feet below ground to save its miners' time.

SAXON CARS USED BY U. S. ARMY IN MEXICO

It took a Saxon to demonstrate to Uncle Sam's engineers that a six-cylinder motor car is fit for the gruelling service of Pershing's expedition in Mexico.

Since the boys in khaki crossed the Rio Grande every motor truck supply train has been piloted by a four-cylinder motor car. The quartermaster's department refused to believe that a six-cylinder could stand the hardships of the mountain trails.

Finally it was decided to give the "Six" a trial, and a Saxon motor car dealer was asked to furnish a car at his own risk as pilot for the supply train.

The Saxon "Six" was sent as pilot from Columbus, Texas, to Ojo Federico, a distance of 62 1-2 miles. The mud was so deep on this road that at one point it took the train nearly all day to go a distance of seven miles. The Saxon was driven with the mud pans dragging. The bottom of the crank case was polished bright from the rubbing of the mud. Even with this condition, there was absolutely no trouble encountered with the car, and, arriving at its destination, it was washed and sent to the machine shop for inspection, and the citizen inspector made the report that the car was mechanically perfect and a sale was made on the spot.

The success with which this Saxon "Six" survived this gruelling test has led the United States government to place eight six-cylinder Saxons on trial in the last week, and every one of them is making good. The government demands an extended trial of every car before making its purchase. They operate on the theory that no car is worth having whose manufacturer is not willing to back its qualities against the toughest conditions which can be imposed on it.

The progress which motor car manufacturers are making in placing cars with the army should be of interest to every motorist. The qualities which can survive the army test are qualities which will carry the average motorist "there and back" with absolute surety and safety.

—oo—

SENATOR SMOOT BOUGHT STUDEBAKER

Breaking all previous speed records between Oakland and San Jose, Cal., a Studebaker "Six" loaded with an extra "Election Edition" of the Oakland Tribune, covered the 45 miles between the two cities in 42 minutes—an average speed of 62 miles an hour. The car was driven by C. F. Orra, of the Weaver-Ables & Wells company, Studebaker distributors, and the remarkable performance was the talk of the town the day after election. The car used was a regular seven-passenger touring model, taken from stock.

It is learned from factory officials and local dealers that, so far, the list of prominent buyers of series 18, Studebaker cars, includes members of the president's cabinet, governors of seven states, United States senators, state senators, United States congressmen, mayors of large cities, noted jurists, bank presidents and directors, great manufacturers, presidents and directors of great corporations, nationally known clergymen, famous authors, champion athletes, famous big league baseball players, favorite stars of the stage and screen.

The Cleveland, Ohio, dealer reported the sale of a Series 18 Studebaker "Six" to Frank Rockefeller, brother of the oil king. Secretary of the Navy Josephus Daniels couldn't resist the luxury and refinement of a Studebaker limousine, and "Uncle Joe" Cannon, ex-speaker of the house of representatives, at once concluded he wanted a Studebaker. Chicago Studebaker distributors said that December 4 at their salesrooms gave every evidence of a pre-arranged gathering of Chicago's most prominent people. They reported 52 sales, among them A. H. Wheeler, president of the Chicago Automatic Telephone company., J. B. Forgan, president of the First National bank, and George K. Schmidt, Cook county assessor.

Norman E. Mack, former chairman of the national Democratic committee, Senator Smoot of Salt Lake City, Victor L. Berger, first Socialist representative elected to congress; Senator Lafe Young and other men high up in political and public affairs examined the new Series 18 Studebakers Monday, December 4, and by placing their orders helped to make Prominent Buyers' day the greatest day in automobile history.

—oo—

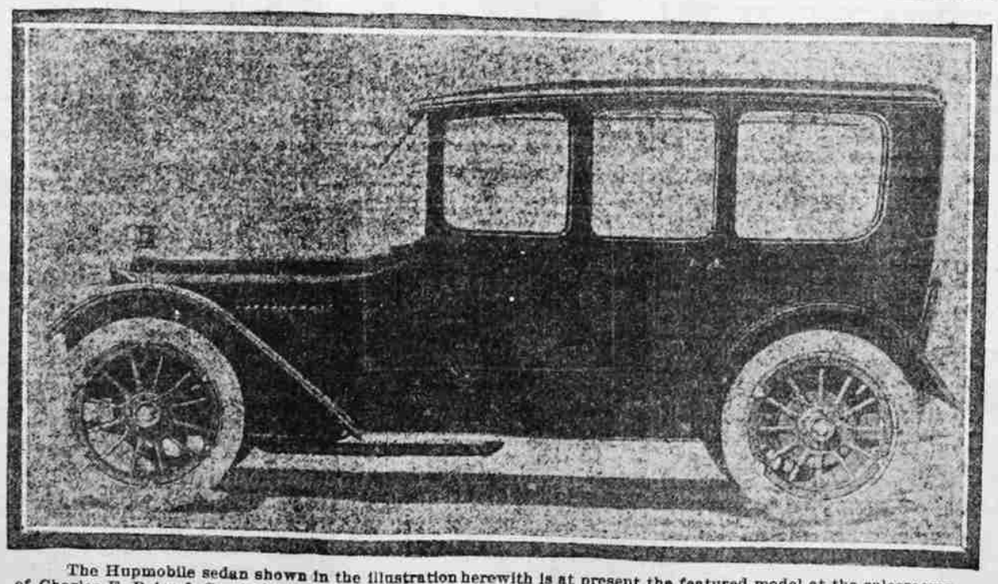
THE MAXWELL'S ECONOMY TRIP

It is said that the Maxwell has succeeded in making a circuit of the intermountain country with a former economy mark of 46 6-10 miles per gallon of gasoline, a remarkable feat. The conditions are claimed to have been adverse to a real economy test, yet the standing of the Maxwell was maintained, much to the satisfaction of the manufacturers, dealers and owners of the car.

The car carried four passengers, two of whom were women. The sturdy Maxwell lived up to its well known reputation, and easily breasted the ruts that sought to deter its progress. It traveled 700 miles in 53 hours, on an average of 20 miles per gallon of gasoline. Of course it was impossible to reach the Maxwell standard of economy over a long and rough road and yet the performance was very extraordinary. Only one quart of oil was used during the trip.

The trip was a most convincing demonstration of economy and reliability. The route followed was a continuous stretch of ruts and hills. Tennessee Pass, one of the points attained, being at an elevation of 10,430 feet, "The Top of the World." On the trip no repairs or mechanical adjustments were required.

SEDAN IS FEATURE OF HUPMOBILE LINE



The Hupmobile sedan shown in the illustration herewith is at present the featured model at the salesrooms of Charles E. Reiss & Co., in New York city. A body that is free from rattle and a short turning radius are advantages of this model.